AD-A190 820 AN EVALUATION AND ANALYSIS OF THE UNITED STATES NAVY'S SUPPLY SUPPORT FOR..(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA J G RIPPERTON DEC 87 1/1

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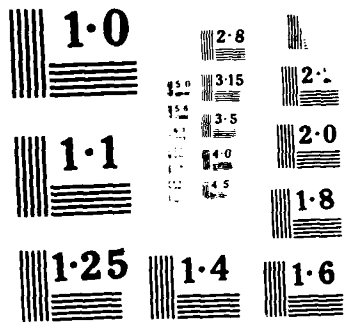
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN EVALUATION AND ANALYSIS OF THE UNITED STATES NAVY'S SUPPLY SUPPORT FOR AIR-LAUNCHED MISSILES AND SUPPLY SUPPORT ALTERNATIVES FOR THE NAVAL AIR SYSTEMS COMMAND OMNIBUS PROGRAM

by

John Gregory Ripperton

December 1987

Thesis Advisor: Thomas P. Moore

A193 92

REPORT DOCUMENTATION PAGE

1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION AVAILABILITY OF REPORT Approved for public release; distribution is unlimited
2b DECLASSIFICATION DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION Naval Postgraduate School; 6b OFFICE SYMBOL (If applicable) Code 54	7a NAME OF MONITORING ORGANIZATION Naval Postgraduate School
6c ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000	7b ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000
8a NAME OF FUNDING SPONSORING ORGANIZATION; 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c ADDRESS (City, State, and ZIP Code)	10 SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO; PROJECT NO; TASK NO; WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)
AN EVALUATION AND ANALYSIS OF THE UNITED STATES NAVY'S SUPPLY SUPPORT FOR AIR-LAUNCHED MISSILES AND SUPPLY SUPPORT ALTERNATIVES FOR THE NAVAL AIR SYSTEMS

12 PERSONAL AUTHOR(S)
Ripperton, John G.

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Master's Thesis	FROM ____ TO ____	1987, December	90

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Supply Support of Air-Launched Missiles; Supply Support for Naval Air Systems Command's OMNIBUS Program; Intermediate and Depot Level Maintenance

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

This thesis provides an assessment of the existing supply support system for intermediate and depot air-launched missile maintenance. Through examination of the supply support structure, the research effort is directed at determining the quality of supply support being provided to air-launched missile maintenance facilities. The thesis provides conclusions on the performance of the existing supply support system and provides recommendations for improvements in the system. In addition, this thesis develops possible alternatives for supply support of the Naval Air Systems Command's proposed Omnibus project which proposes the combining of intermediate and depot levels of maintenance for air-launched missiles. Applicable measures of effectiveness which may be used in analyzing the various alternatives are also identified and discussed. Recommendations are made concerning

20 DISTRIBUTION AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL Prof. Thomas P. Moore	22b TELEPHONE (Include Area Code) (408) 646-2642; 22c OFFICE SYMBOL Code 54Mr

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE

U.S. Government Printing Office: 1986—606-243

UNCLASSIFIED

#11 - TITLE - (CONTINUED)

COMMAND OMNIBUS PROGRAM

#18 - SUBJECT TERMS - (CONTINUED)

of Air-Launched Missiles

#19 - ABSTRACT - (CONTINUED)

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Accession For
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Unannounced
Justification

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Distribution/
Availability Codes
Dist | Avail and/or Special
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Approved for public release; distribution is unlimited

An Evaluation and Analysis of the United States Navy's Supply Support for Air-Launched Missiles and Supply Support Alternatives for the Naval Air Systems Command Omnibus Program

by

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1987

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This thesis provides an assessment of the existing supply support system for intermediate and depot air-launched missile maintenance. Through examination of the supply support structure, the research effort is directed at determining the quality of supply support being provided to air-launched missile maintenance facilities. The thesis provides conclusions on the performance of the existing supply support system and provides recommendations for improvements in the system. In addition, this thesis develops possible alternatives for supply support of the Naval Air Systems Command's proposed Omnibus project which proposes the combining of intermediate and depot levels of maintenance for air-launched missiles. Applicable measures of effectiveness which may be used in analyzing the various alternatives are also identified and discussed. Recommendations are made concerning which measures of effectiveness the Naval Air Systems Command should use in selecting an alternative for the Omnibus concept.

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I. INTRODUCTION

A. BACKGROUND

On February 25, 1986 President Reagan signed Executive Order 12552 entitled the Productivity Program for the Federal Government. The objectives of this program are to improve the quality, timeliness and efficiency of services provided by the Federal Government [Ref. 1:p. 7041]. The specific goal of the program is to achieve a 20 percent productivity increase in appropriate functions by 1992. The President tasked each executive department and agency to contribute to the achievement of this productivity increase.

The efforts of the Secretary of the Navy to comply with Executive Order 12552 began with a program called Attack Cost Through Improvements In Our Navy (ACTION'88). In this program the Secretary of the Navy stated that his objectives were to reduce the cost of acquiring, operating and maintaining the Navy's equipment and systems [Ref. 2]. The Assistant Secretary of the Navy for Shipbuilding and Logistics, Mr. Everett Pyatt, was placed in charge of this program. The program was designed to achieve one billion dollars in cost reductions through productivity improvements by the end of fiscal year 1988.

One of the projects to achieve ACTION '88 goals is being developed by Naval Air Systems Command Code 418 (NAVAIR-418). This new program will if implemented, combine two

levels of air-launched missile (ALM)[1] maintenance into one level of maintenance. The existing levels of ALM maintenance are predominantly performed by Navy (organic) activities. The program would allow both organic and commercial activities to vie for the contract to perform the new level of maintenance.

NAVAIR-418 acts in the capacity of a maintenance and logistics management coordinator for ALMs since all of the missile maintenance and support services are performed at facilities which belong to other commands or the commercial sector. Transportation and supply support are provided by the Naval Supply Systems Command.

The maintenance plan for ALMs currently calls for three levels of maintenance: Organizational (O) level, Intermediate (I) level and Depot (D) level. Organizational level maintenance is performed by Navy fleet units; intermediate maintenance is provided by Naval Sea Systems Command (NAVSEA); and depot maintenance is performed by Naval Aviation Depots (NADEPs) and designated commercial overhaul points (DOPs) [Ref. 3:p. 10].

1. Organizational Level Maintenance

Organizational maintenance is the lowest level of repair that can be performed on an ALM and is the responsibility of fleet aircraft squadrons stationed aboard

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[1]ALMs are missiles which are usually fired from Navy aircraft and include the Sidewinder, Phoenix, Harpoon, Shrike, Walleye, Sparrow and Harm missiles.

an aircraft carrier (CV, CVN) or at Naval Air Stations (NAS). Organizational maintenance is constrained to extremely simple tasks which include:

(1) removing the missile from the storage container

(2) attaching flight control surfaces (wings)

(3) uploading and downloading of missiles from aircraft.

Diagnostic testing of missiles and replacement of faulty internal missile components and missile sections are not performed at this level of maintenance. Testing at the organizational level is limited to determining if the missile is functioning properly or not (go/no go testing). An example of testing performed at this level would be checks to insure electrical continuity of the missile system [Ref. 3:p. 15]. Figure I-1 provides a representation of a generic ALM with its various missile sections.

2. Intermediate Level Maintenance

The intermediate level is the next echelon of maintenance. ALMs require induction into an Intermediate Maintenance Activity (IMA) if they meet one of the following four criteria [Ref. 4:pp. 9-10]:

(1) Expiration of Serviceable-In-Service-Time (SIST). SIST is the length of time a missile can be made available for use without an IMA inspection. After every IMA inspection a new maintenance due date (MDD) is assigned to the missile based on the SIST and service life[2].

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[2]Service life is defined as the maximum lifetime of the missile.

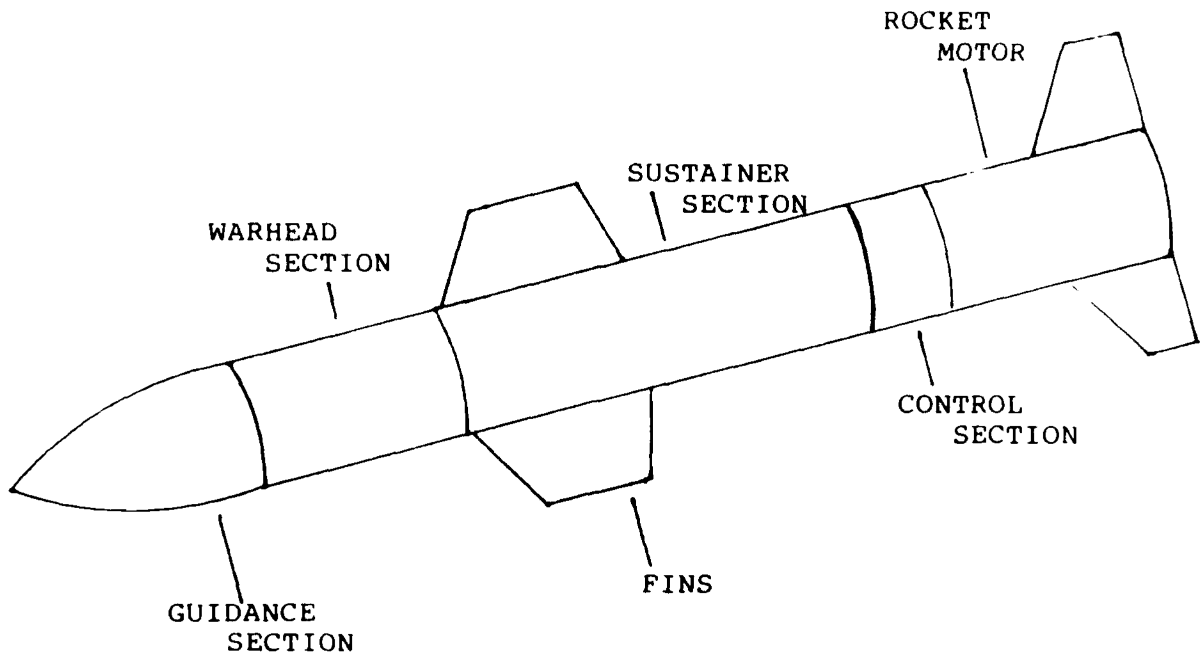

Figure I-1 Generic Air-Launched Missile

(2) Missile failure. Reasons for failure can include damage in shipping and handling as well as corrosion caused by exposure to salt water while uploaded on an aircraft.

(3) Missile has been used for a captive flight on an aircraft. When a missile has been taken from a storage container, loaded on an aircraft and flown on an aircraft mission but not fired, the missile must be returned to the IMA at the end of the carrier deployment for inspection and cleaning.

(4) Missile requires conversion. Conversion is a process which upgrades a missile and is accomplished by replacing or modifying missile components.

The intermediate maintenance for ALMs is performed at Naval Weapons Stations (NWS) with one exception: Missile Maintenance Unit One (MMU-1) located in Subic Bay, Republic of the Phillipines. The NWSs become the focal points of the missile logistics network. All new production missiles, reworked missiles, and missiles turned in by the fleet must successfully pass testing at the intermediate level before being certified as ready-for-issue (RFI). Missiles must be certified as RFI before they are loaded out on fleet units.

The concept for testing at IMAs calls for missile sections to be assembled and tested as a complete missile, which is called an All-Up-Round (AUR), instead of being tested in individual sections. Components or sections which do not pass testing can be replaced at the IMA. These failed components become the candidates for depot level repair. In addition, there are certain types of modification kits which can be installed by the IMA.

In addition to MMU-1 there are three activities which presently provide intermediate maintenance for ALMs. They are the Concord Naval Weapons Station located in Concord, CA; Yorktown Naval Weapons Station located in Yorktown, VA; and Seal Beach Naval Weapons Station, Fallbrook Annex, Fallbrook, CA. Naval Sea Systems Command is ultimately responsible for operating these facilities.

3. Depot Level Maintenance

Depot level maintenance performed at designated overhaul points (DOPs) is the highest level of maintenance authorized on ALMs. The IMAs forward failed components and missile sections to the designated overhaul points (DOPs) for repair.

AURs are not currently sent to the depots by the U.S. Navy for repair. However, in the case of the Harpoon missile many foreign governments possessing the Harpoon missile system send AURs to United States depots for repair and return because they lack intermediate level maintenance facilities.

Depot level maintenance is performed at both organic (Navy) and commercial activities. The primary organic depots are the NADEPs. The two NADEPs engaged in ALM repair are NADEP Norfolk located in Norfolk, VA and NADEP Alameda located in Alameda, CA. There are 12 commercial activities engaged in depot repair. Most of these commercial

activities use their missile production facilities to repair missiles.

McDonnell Douglas Astronautics Company (MDAC) has built an independent depot maintenance facility for repair of the Harpoon missile. Depot level maintenance of ALMs usually transitions from the prime contractor to a NADEP as prescribed by the Integrated Logistics Support Plan (ILSP). In this unique case MDAC was selected to be the depot maintenance facility for the life of the Harpoon missile.

Maintenance at the depot level is both extensive and complex. Extremely sensitive diagnostic testing is performed which will allow for repairs at the lowest possible subcomponent level. Modification kits may also be installed at the depot level.

4. Contracting for the New ALM Maintenance Concept

The organizational level of maintenance will not be affected by the new maintenance concept. Organizational level maintenance will continue to be performed by military personnel.

The Federal Government has recently placed great emphasis on the contracting out of services to the commercial sector, as well as encouraging the growth of full and open competition [Ref. 5]. Contracting for the new ALM maintenance concept will be in keeping with this guidance by allowing both organic and commercial activities to bid on the contract.

The new combined intermediate and depot maintenance concept is called the Omnibus. The Omnibus will be required to perform all of the functions currently being performed by the two levels of maintenance it is replacing. An Omnibus contractor will not be required to perform the direct receipt function and the storage and issue of missiles at the waterfront.[3] This function will remain at the Naval Weapons Stations.

Under the Omnibus concept, AURs which are not RFI will be returned by the fleet units to an NWS for transhipment to the organic or contractor's maintenance facility. The reasons for declaring an AUR not-ready-for-issue (NRFI) would be the same as previously described for induction into an existing IMA.

The maintenance to be performed at the combined maintenance facility will include: test of the AUR, disassembly of the missile sections (if required), test of the failed section, repair of the section and reassembly.

At this point it should be made clear that this new maintenance concept is still under development. A briefing on the plan was given to representatives of commercial and

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[3]In addition to performing intermediate maintenance on ALMs NWSs also provide storage of the ALMs in magazines. When the ALMs are required for a carrier deployment the missiles are loaded onto an ammunition ship (AE) for further delivery to the carrier. Upon termination of a deployment the carrier will offload ALMs to an AE for further transport back to an NWS. NWSs also receive new production assets from contractors.

organic activities on 27 July 1987. Activities interested in the concept were asked to provide responses to a Request for Information no later than 1 December 1987. NAVAIR-418 intends to gather enough data from these responses to write a Request for Proposals (RFP).

Some of the aspects of the concept which are to be addressed in the responses include the following:

(1) feasibility of developing a generic/common set of test equipment to repair each type of ALM included in the Omnibus

(2) provisions for a transportation pipeline to and from the NWS and the Omnibus facility or facilities

(3) provisions for the contractor to provide full supply support for the Omnibus maintenance facility

(4) provisions for obtaining maintenance engineering for the ALMs in the Omnibus.

The Omnibus concept will apply to the ALMs and equipment listed in Appendix A.

In addition to the direction provided by the Assistant Secretary of the Navy for Shipbuilding and Logistics to pursue this new maintenance concept, NAVAIR-418 also has additional incentives to explore the Omnibus concept. One of the key incentives is the tremendous future growth of the ALM inventory. By the year 2000 this inventory will have tripled in size. Because of a projected austere fiscal outlook it is forecasted that the budgets for maintenance will not receive the same percentage of growth as the budgets for ALM inventories [Ref. 6].

Also of major concern is that military construction funds are not expected to be made available to build additional facilities which will be required to meet the maintenance needs of the growing ALM inventory.

NAVAIR-418 hopes that increased productivity and economies arising from the Omnibus concept will allow for performance of all required maintenance actions within the anticipated budget constraints.

B. PURPOSE

The purpose of this thesis is twofold. First an assessment is made of the existing supply support system for intermediate and depot ALM maintenance. Aspects of the supply support structure will be examined to make a determination about the quality of supply support being provided to the maintenance facilities.

The second purpose of this thesis is to identify and analyze the alternatives for supply support of the Omnibus.

C. RESEARCH QUESTIONS

Given the first purpose of this thesis the following research questions were formulated:

1. Is the existing supply support for intermediate and depot ALM maintenance facilities adequate? If not, determine the root causes of this inadequacy.

2. Determine if the existing supply support structure can be improved.

Given the second purpose the following research questions apply:

1. Determine the various alternatives to provide supply support for the Omnibus program.

2. Identify the applicable measures of effectiveness (MOEs) to be used in evaluating these alternatives.

D. SCOPE

This study will provide an analysis of the existing supply support posture for intermediate and depot level maintenance of ALMs. It will further provide an analysis of the supply support needs of the Omnibus program. A major thrust of the thesis will be to provide a comparison of the supply support which can be provided by the Navy and that which can be provided by the commercial sector.

McDonnell Douglas Astronautics Company (MDAC) has been in the forefront of industry's efforts to obtain government contracts for depot level maintenance of ALMs. Because of these efforts and their willingness to provide data on supply support from their existing depot ALM maintenance facility, MDAC will be used as a representative commercial depot facility for comparisons in this study.

This study will focus on the 1H and 7E cognizance group items as they comprise the biggest portion of the ALM material supply support provided to NWSs and NADEPs by SPCC.

E. LIMITATIONS

Supply support of ALMs is an extremely unique subject. ALM weapons systems fall under the cognizance of NAVAIR which is predominantly concerned with the development,

procurement and management of aircraft weapons systems. The Navy's Aviation Supply Office (ASO) in Philadelphia, PA is the inventory control point (ICP) which is dedicated to providing supply support to these aircraft weapons systems. It would seem logical that since the ALMs are launched from aircraft platforms and because they are managed by NAVAIR that the ICP for ALM repair parts would be ASO. This is not the case. Since ALMs are classified as weapons instead of aircraft, the Navy's ICP for ALMs is the Ships Parts Control Center (SPCC) in Mechanicsburg, PA. ALM supply support is only a very small portion of the volume of business transacted by SPCC whose major responsibility is to provide supply support for submarines, surface ships and their support equipment. In addition, the Naval Weapons Stations (NWSs) providing the intermediate maintenance support for ALMs are under the control of Commander Naval Sea Systems Command (NAVSEA) and the Naval Aviation Depots (NADEPs) providing the depot level ALM maintenance are under the control of NAVAIR. Both the NWSs and NADEPs are managed as Naval Industrial Fund (NIF) activities.

The command relationships described above have led to interesting developments in supply support. For example, because the NWSs and NADEPs are NIF activities, they cannot receive a Consolidated Shorebase Allowance List (COSBAL) to support their maintenance requirements since COSBALs are funded by the Navy Stock Fund (NSF). There also have been

several unique supply support programs created by the existing supply structure. Examples of these programs include the Industrial Demand Forecasting (IDF) program run by SPCC and NAVAIR and the Harpoon Depot Support Material List (DSML) at MDAC. Comparative analysis of these programs was not possible because the structures of the programs are very different, there are different constraints applied to each program, and most of the data being collected under each program is incompatible.

F. ORGANIZATION

This thesis is divided into five chapters, an introduction, three research chapters, and a final chapter which includes a summary, conclusions and recommendations. Chapter II provides an analysis of the existing supply support system for intermediate and depot level maintenance of ALMs. Chapter III identifies supply support alternatives for the Omnibus concept and provides an analysis of each alternative. Chapter IV identifies measures of effectiveness (MOEs) which can be used to evaluate the alternatives which were identified in Chapter III. Chapter V provides a summary of the analysis and makes conclusions and recommendations.

II. THE EXISTING SUPPLY SUPPORT SYSTEM FOR INTERMEDIATE AND DEPOT LEVEL MAINTENANCE OF AIR-LAUNCHED MISSILES

One of the key elements which contributes to the operational capability and availability of ALMs is logistic support. A well defined integrated logistics support plan (ILSP) will keep critical systems in the desired state of readiness.

Integrated logistics support planning calls for the designing of support concurrent with system design so that an optimal blend of support elements can be obtained. These integrated logistics support (ILS) elements include [Ref. 7:pp. 4-65]:

(1) Maintenance planning

(2) Manpower and personnel

(3) Supply support

(4) Support equipment

(5) Technical data

(6) Training and training support

(7) Computer resources support

(8) Facilities

(9) Packaging, handling, storage and transportation

(10) Design interface.

Using logistic support analysis (LSA), ILS elements and system designs are subjected to numerous tradeoffs. The

emergent products are those which meet system readiness objectives at the minimum cost.

The ILS element pertaining to ALMs which is of concern to this study is supply support. Supply support is a rather broad area as the following definition shows:

> Supply support includes all spares (units, assemblies, modules, etc.), repair parts, consumables, special supplies and related inventories needed to support prime mission oriented equipment, software, test and support equipment, transportation and handling equipment, training equipment and facilities. Supply support also covers provisioning documentation, procurement functions, warehousing, distribution of material and the personnel associated with the acquisition and maintenance of spare/repair part inventories at all support locations. [Ref. 8:p. 10]

A. NAVY SUPPLY SUPPORT PROVIDED TO NAVY REPAIR ACTIVITIES

NAVAIR-418 is the inventory control point (ICP) for ALMs, missile sections, wings, fins, All-Up-Round (AUR) containers and certain support equipment. This material has cognizance symbol 8E. SPCC is the ICP for repairable and consumable repair parts and missile section containers. This material has cognizance symbols of 1H and 7E. Table II-1 is a complete listing of cognizance symbols applicable to ALMs which are managed by Navy ICPs [Ref. 9:pp. 7-1].

As previously noted in Chapter I-D, this thesis will focus on the 1H and 7E cognizance group items because they constitute the greatest portion of the ALM material supply support being provided by SPCC to the NWSs and NADEPs.

When a new ALM system is acquired by the Navy, the supply support program is usually divided into two distinct

TABLE II-1

COGNIZANCE SYMBOLS

Item Description	Cognizance Symbol
Missile repair parts (consumable)	1H
Missile explosives and repair parts	2E/4E
Support equipment (major test sets)	2V
Support equipment (minor test equipment)	6M
Missile repair parts (repairable)	7E
Missile components, sections and containers	8E

phases. Phase I is called Contractor or Augmented Support and Phase II is called Operational Support.

Contractor Support may call for the contractor to provide supply support to all three levels of ALM maintenance. This support plan usually calls for the contractor to stock repair parts (both consumables and repairables) at the maintenance sites. These stocks of material are called Support Material Lists (SMLs). These SMLs are funded by NAVAIR.

Operational supply support begins when Navy activities become capable of providing the supply support for the missile. This is referred to as the Material Support Date (MSD). The MSD should be scheduled 90 to 180 days prior to the Navy Support Date (NSD) targeted for the ALM. The Navy

Support Date is the date when the Navy can effectively employ the ALM in a fleet unit [Ref. 10:encl.3:p. 2].

Prior to the MSD the missile system must go through a provisioning process. As the Program Support Inventory Control Point (PSICP) for ALM repair parts, SPCC must receive certain data which is essential to the provisioning process. Two of the key data elements are the Program Support Data (PSD) and Provisioning Technical Documentation (PTD).

1. Program Support Data

PSDs are necessary for the requirements determination of initial, interim and follow-on secondary item spares and repair parts [Ref. 10:p. 1]. PSD inputs are provided by NAVAIR-418 to SPCC (Code 0533). PSDs must describe each item of hardware acquisition for an ALM weapon system in complete detail and should be submitted to SPCC a budget leadtime (approximately 3 years) in advance of the anticipated requirement. PSDs are to be submitted for all new end item procurements, field changes and modifications to equipment, additional equipment procurements, procurement terminations, and for planning revisions of the weapon system. Planning revisions noted above refer to any significant changes made in an end item's procurement cost, quantities or schedule. The submission of timely and accurate PSDs to the PSICP is essential for the supply support of ALMs as the following excerpt from Naval Material Command Instruction 4420.2A explains:

> The importance of providing accurate PSD on all current and planned equipment acquisitions cannot be overemphasized; it is fundamental to assuring that resources will be available for spares and repair parts procurement. [Ref.10: encl. 1:p. 1]

The PSD has two purposes. The first is to allow NAVAIR to develop the secondary item budget for interim support[4] repair parts. The second is to allow SPCC to develop a secondary item[5] budget for the retail and supply system repair parts requirements.

2. Provisioning Technical Documentation

The Provisioning Technical Documentation (PTD) is the technical information about an equipment from which SPCC can determine the repair parts that will be required to support it. The PTD which is usually procured from the prime contractor includes the Provisioning Parts List (PPL).

3. Provisioning Conference

When SPCC has all of the preliminary provisioning data assembled a provisioning conference is held to determine which items will be initially stocked in the supply system.[6]

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[4]Interim repair parts support may be required to support a weapons system prior to that system reaching its Navy support date. Interim support is usually provided by the prime contractor.

[5]Secondary items are end items which are consumable or repairable and do not constitute a principle item. Principle items such as ships and aircraft are a final combination of end items.

[6]This decision is only made for items not already stocked in the supply system. Those items which are already stocked don't have any additional stock added to the inventory in

Representatives from SPCC, NAVAIR, prime contractors, sub-contractors, Pacific Missile Test Center, Point Mugu, CA and Naval Weapons Center, China Lake, CA may be in attendance at a provisioning conference for an ALM weapon system.

Utilizing the PPL, representatives at the conference will make the following assignments [Ref. 11:pp. 2-30]:

(1) Source, Maintenance, Recoverability (SM&R) codes

(2) Technical Replacement Factors (TRFs)

(3) Initial Best Replacement Factors (BRFs)

(4) Allowance Overrides

(5) Military Essentiality Codes (MECs)

Those new items selected for provisioning and management by SPCC will be cataloged by the Defense Logistic Service Center (DLSC) and assigned a National Stock Number (NSN).

4. Provisioning Supply Support Computations

Retail and wholesale stock requirements are computed by SPCC for new items. Utilizing the Navy Stock Fund (NSF) SPCC will "buy-in" to the supply system inventory requirements. This material will subsequently be sold to the end user. Funds received from the sale will be used to reimburse the NSF.

For existing items of supply managed by SPCC, Planned Program Requirements (PPRs) will be loaded into the

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anticipation of the future support requirements of the new missile.

computerized files which will ultimately create additional stock buys through the Supply Demand Review (SDR) program [Ref. 11:pp. 2-30].

Provisioned items requiring supply support which are not managed by SPCC will be obtained by using a Supply Support Request (SSR). The SSR will be sent to the appropriate ICP which manages the item and will include the predicted annual demand and retail outfitting requirements.

5. COSAL/COSBAL Support

A Coordinated Shipboard/Shorebase Allowance List (COSAL/COSBAL) provides the organizational level of maintenance with a complete listing of equipment and spare parts authorized for stockage at their activity. Supporting Supply Departments will ensure that this material is on hand, on order, or being pushed to the activity.[7]

The intermediate maintenance facilities are less fortunate in their supply support posture. The Integrated Logistics Support Plans (ILSPs) for ALMs indicated that a COSBAL would be utilized to support the IMAs. The ILSPs indicate that to obtain COSBAL support, NAVAIR-418 should submit a request to SPCC (Code 0533) via NAVSUP. However, because all the Naval Weapons Station IMAs are funded by the

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[7] COSALs which are prepared by SPCC are designed to support the organizational level of maintenance on the aircraft carrier. COSBALs which are also prepared by SPCC are designed to support the aviation squadron's organizational maintenance needs when it returns to a Naval Air Station between carrier deployments.

Navy Industrial Fund (NIF), they are excluded by Naval Supply Systems Command from obtaining COSBAL support [Ref. 12:p. 1]. This is in contrast to the aviation community where the IMAs are not NIF activities and are fully supported by a Shore Consolidated Allowance List (SHORCAL) provided by ASO. COSBALs cannot be prepared for organic depot maintenance facilities as they are also NIF funded activities.

The lack of a COSBAL to support the NWS IMAs has affected the quality of supply support being provided to the IMAs, especially in the area of support equipment [Ref. 13].

A COSBAL is designed to support a naval shore based activity's maintenance efforts in the same manner as a COSAL supports a ship. Exceptions that are made in COSBAL processing from that of a COSAL include manipulation of the protection period and insurance range criteria. A COSBAL will provide a consolidated listing of spares, repair parts and consumable items which have been tailored to the specific activity's requirements. The COSBAL further contains the authorized allowance quantities of non-demand based items required to support the activity. Included among these r[illegible]ents are many insurance items which are vital to effe[illegible]e supply support of the IMA's support equipment. C[illegible]tion of a COSBAL for NWS IMAs would allow for protected s[illegible]ockage of vital insurance items at each IMA.

NIF activities are not precluded from stocking required materials in their NIF stores account. However, to stock these items requires the Navy Industrial Fund (NIF) to buy the material from the Navy Stock Fund (NSF). The price tag for the consumable requirements is not prohibitive, and even though the items may not meet demand criteria required for a NIF stores account, they can be stocked as insurance items [Ref. 14:pp. 1-43]. Repairable assets can also be stocked in NIF inventories. However, the cost of initially stocking these items is extremely high because the assets must be bought from the Navy Stock Fund (NSF) at the standard price.[8] NIF activities cannot afford to have high levels of investment in material inventories. For example, to keep the level of material investment to a minimum, NADEP Alameda stocks no repairable items in their stores accounts. Other activities, such as NWS Concord, maintain minimal quantities of repairable items. Because of this, the insurance assets which are essential to maintaining high levels of productivity at the IMAs and depots are not available in the NIF activities stores accounts and may not be readily available from wholesale system stock.

[8]Standard price is the full price of a repairable asset. Net price is the price an activity would pay if they had a not-ready-for-issue (NRFI) repairable carcass to turn into the supply system.

6. Naval Weapons Station and Naval Aviation Depot Supply Support

At this juncture it is important to note that NWSs are also stock points for designated wholesale system stock for ALM material. They report inventory transactions to SPCC using the Transaction Item Reporting (TIR) system. In contrast, NADEPs performing depot ALM maintenance are not wholesale stockpoints. If a NADEP does not have an item in NIF stores, its point of entry for the requirement into the supply system is the supporting supply center, which for NADEP Alameda is NSC Oakland and for NADEP Norfolk is NSC Norfolk. If an IMA at an NWS has a repair part requirement which isn't available from NIF stores at a NWS, it is then screened for availability from the NWS's wholesale stock. If not available from on hand assets it is referred to SPCC. If a NSC cannot fill a NADEP's requirement, it will also be referred to SPCC for further supply action.

It would seem that since the NWSs have both NIF stores material and wholesale stock on hand, they should be able to provide the IMAs with the requisite levels of supply support. The NWSs do have the means to provide adequate supply support for those items which generate sufficient demand. However, for those critical insurance items which are repairables with low demand (primarily required for support equipment) there appears to be a complete breakdown in the supply support mechanism. The requirements cannot be identified and supported by a COSBAL nor are they adequately

supported in the NIF inventories because of the high cost of the investment.

An example of this dilemma is highlighted in a message from NAVAIR to SPCC in July 1987 which addressed the lack of supply support for the Harpoon Missile Subsystem Test Set (MSTS) [Ref. 15]. The MSTS is an automatic test set for Harpoon missile section testing. There are four of these test sets located at two sites, NWS Concord and NWS Yorktown. The following specific points were addressed:

(1) Based on 1985 data accumulated by NWS Concord only 40 percent of demands for MSTS material were satisfied by on hand material at NWS Concord.

(2) 20 percent of those requirements not satisfied by NWS Concord were satisfied by either cannibalization action of another test set or from a service contract with Hewlett Packard.

(3) The remaining 40 percent which were not satisfied locally were referred to SPCC.

(4) MSTS maintainability specifications call for a Mean-Time-To-Repair (MTTR) of 4 hours in order to achieve an operational availability (A_o) of 85 percent.

(5) Requested that if SPCC was unable to improve MSTS supply support to acceptable levels, then all MSTS peculiar spares and residual MSTS initial investment items (SML assets) be turned over to NAVAIR-418 management at no cost effective 1 January 1988.

Discussions with Mr. Dave Bainbridge, SPCC code 05332, indicate that few improvements can be made in MSTS support and ALM support in general unless the restriction on providing COSBALs to Naval Weapons Stations is rescinded by NAVSUP [Ref. 13]. The wholesale provisioning models often

do not generate adequate support for the critical insurance items especially in the area of major support equipment.[9]

If the restriction on providing COSBAL support was lifted, the COSBAL would have to be computed using the Modified Fleet Logistics Support Improvement Program (MOD-FLSIP) which uses an exclusion factor of .1 demand per year. Current instructions for preparing a COSBAL to support a shorebased activity in the Continental United States (CONUS) that does not have a mission which requires deployment call for computations based on the Fleet Logistics Support Improvement Program (FLSIP) utilizing an exclusion factor of 1.0 demand per year [Ref. 12:p. 4]. The problem with the FLSIP program is that it fails to identify and recognize many critical repair parts essential to an activity's mission. It also fails to support critical items with historical demand just below the insurance threshold criteria for insurance stockage (Ref. 11:pp. 2-50). The MOD-FLSIP computed COSBAL is designed to provide support for those insurance items which are excluded by the FLSIP model.

An option for providing better support to the NWSs which could also be used at the organic depots would be for SPCC to prepare a COSBAL for informational use for these activities. The NIF activities could use these COSBALs to

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[9]An example of this is provided by SPCC's System Material Availability (SMA) of 62.3 percent for the Harpoon MSTS for the months of June, July, August 1987. This is well below SPCC's goal of 85 percent.

identify those insurance items they need to stock. The NIF activities would have to submit a funded requisition to SPCC to procure these items. Indications are that NIF activities would be willing to maintain these items in their NIF stores if NAVAIR provided the funds to buy the material from the NSF. The material purchased would then be capitalized into the NIF stores account.

To provide emphasis to the argument that measures must be taken to improve ALM supply support, Table II-2 presents statistics that were obtained from SPCC (Code 0533) which reflect the System Material Availability (SMA) for key ALMs. SMA is the measurement system used by SPCC to gage its success in providing wholesale supply support. The goal of SPCC is to achieve an SMA of eighty-five percent or better. It can be clearly seen that in several areas SPCC falls very short of meeting this goal. This directly impacts on ALM maintenance supply support.

TABLE II-2

SPCC SYSTEM MATERIAL AVAILABILITY (PERCENT) FOR JUNE, JULY, AUGUST 1987

Sparrow	Phoenix	Sidewinder	Shrike
65	79.8	61.5	74.9
Walleye	Harm	Harpoon	Harpoon MSTS
85.7	38.8	58.3	62.3

7. Additional Problems Which Affect SPCC's Ability To Provide Supply Support for Air-Launched Missiles

In addition to being prohibited from providing COSBAL support to NWSs and NADEPs, SPCC has two other problems which are affecting its ability to provide supply support for ALMs. The most critical of the problems is that SPCC (Code 0533) is not receiving PSD inputs from NAVAIR-418 in a timely manner and in some cases not receiving the PSD inputs at all. As discussed earlier, PSD inputs are vitally important in ensuring that resources are made available for procuring repair parts and identifying the requirements for repair parts. The problem stems from a lack of communication between NAVAIR-418 and SPCC (Code 0533) which apparently has existed for some time. One senicr NAVAIR-418 official indicated that the only way to solve the communications problem would be to create an ICP which was solely dedicated to missile management and which could be called the Missile Supply Office [Ref. 16].

During fiscal year 1987 SPCC received only two PSD. These were for the Hellfire and Penguin missiles which will be included in the submission of the 1990 Program Objectives Memorandum (POM). SPCC has not received any PSD inputs which document the projected 300 percent increase in the ALM inventory [Ref. 13]. The 300 percent increase in the ALM inventory is graphically depicted in Figure II-1. In a 25 September 1987 letter to NAVAIR-418, SPCC (Code 0533) reiterated that SPCC could take no action to request POM

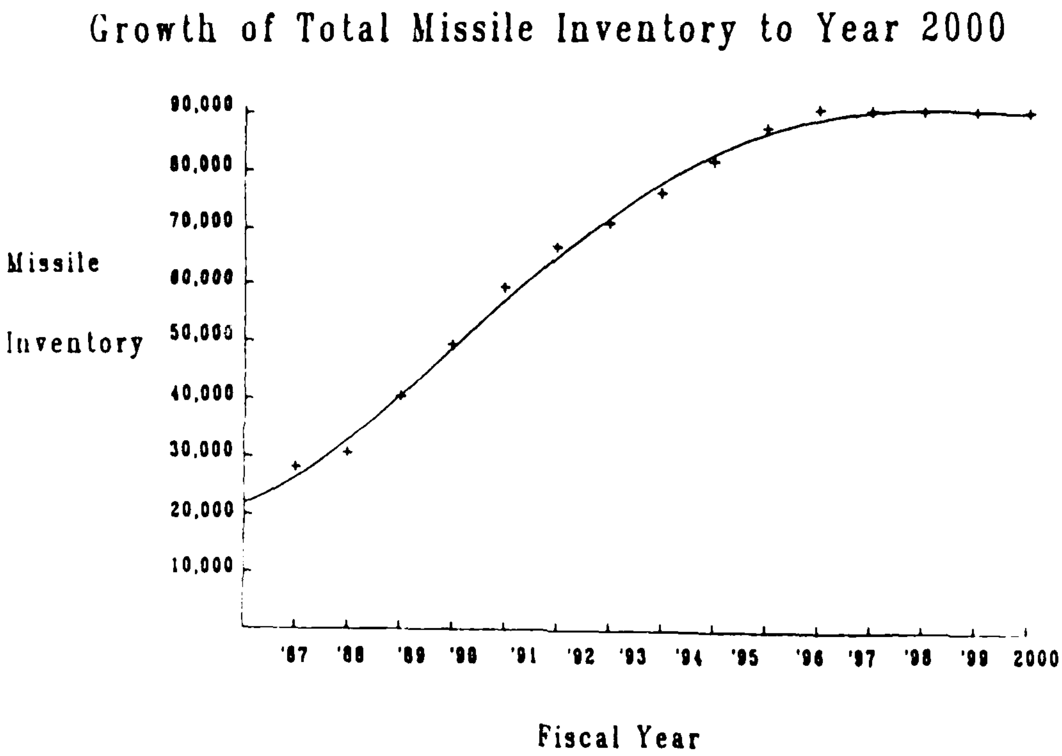

Figure II-1 Growth of Total Missile Inventory to Year 2000 [Ref. 6]

1990 funds for supply support of any missile system, training device, or test set (new or existing system) other than those for which they have received PSD inputs [Ref. 17]. An article in Aviation Week and Space Technology sheds light on the magnitude of the problem. Citing a draft GAO report, it reported that the Navy plans to procure the following ALMs [Ref. 18:pp. 34-35]:

(1) 7,204 AIM-54C Phoenix missiles with an average unit cost of $992,000

(2) 7,944 AIM-7M Sparrow missiles with an average unit cost of $183,000

(3) 3,971 AGM/RGM/UGM-84A Harpoon missiles with an average unit cost of $854,000.

If the new PSD for these missiles and their support equipment is not provided then SPCC will continue to program and budget the support based on the last PSD. This would not be adequate to meet the requirements of the expanded inventory.

It is of utmost importance that the appropriate people at SPCC and NAVAIR resolve the existing communications problem and develop a link which will allow vital information (such as the PSD) to flow in order to secure the best possible supply support within the existing supply system.

Long procurement lead times are also detracting from ALM supply support being provided by SPCC. The average administrative lead time for the procurement of ALM spare and repair parts at SPCC is 10.2 months. This is the time

that it takes SPCC to award the contract. This administrative lead time is consistent with that of other weapon systems at SPCC. The cause of the long lead times is the stringent procurement regulations which are prescribed for the Department of Defense.

8. Initiatives To Improve Air-Launched Missile Supply Support

One program that has been undertaken to improve ALM supply support is called the Industrial Demand Forecasting (IDF) program. The program was started after reviews indicated that forecasting of maintenance demands in the SPCC requirements and budget system could result in considerable improvement in repair parts supply support and alleviate recurring material support problems. An agreement between NAVAIR, NAVSUP, and NAVSEA implemented the program in February, 1986 [Ref. 19].

The basic concept of the IDF program is to provide SPCC with a forecast of what the maintenance activities believe their demand will be for essential repair parts. SPCC's forecasts which are based on historical demand, may be understated. This would negatively affect ALM supply support. Some of the reasons SPCC's data base may be incorrect are as follows [Ref. 19:p. 3]:

(1) Engineering/design changes to end item components result in a variation of demand patterns.

(2) Dynamic end item maintenance programs trying to achieve optimization of availability cause a variation in repair parts demand patterns.

(3) Repair parts are, in many cases repaired concurrent with the end item. Usage data on these types of repairs is not reported into the demand data base.

(4) Allocation of components for U. S. Navy use is affected by interservice, foreign military sales or commercial depot agreements.

NAVAIR, NWSs and NADEPs (performing missile repair) can submit candidates for IDF review by SPCC in February and July of each year. SPCC will perform computations to determine if the IDF maintenance forecast[10] is significantly different from the SPCC forecast. If the demand difference exceeds a specified threshold the NADEP/NWS will be held responsible for funding the procurement of the additional quantities. Such a quantity is referred to as the risk quantity. SPCC goes through a series of steps to determine which activity will assume the responsibility for the risk quantity. These steps are described below [Ref. 19:p. 4]:

(1) Each item is designated as either a slow or fast mover. A slow mover is any item which has 3 or less requisitions per quarter and an actual demand quantity of 25 or less per quarter. A fast mover is an item experiencing more than 3 requisitions per quarter or a total demand quantity greater than 25.

(2) Determine the difference (demand DELTA) between forecasted maintenance requirements and historical demand for each IDF item. The demand DELTA is the total forecasted maintenance requirements for the next eight quarter period, minus the past four

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[10]The IDF maintenance forecast is derived using data from the Air-Launched Missile Maintenance Activity Five-Year Plan for scheduled inductions of missiles and from the Maintenance Data Collection System historical usage rates for end items and components. The maintenance forecasts may differ considerably from SPCC's usage rates because of changes in the induction schedule and design changes in the missile components.

quarters' recorded demand average at SPCC multiplied by two.

(3) Determine the risk quantity based on the current SPCC average quarterly demand for slow movers and two times the SPCC current average quarterly demand for fast movers. The risk decision value is based on a demand DELTA of $2,500. If the demand DELTA is greater than the risk value of $2,500 and greater than the risk quantity the NADEP/NWS has the responsibility to submit a funded Extended Required Delivery Date (ERDD) requisition to SPCC.

When the ERDD requisition is submitted and loaded into SPCC files it will generate a Planned Program Requirement (PPR) (for 1H and 7E cogs) which will in turn generate a procurement. The ERDD requisition will become an active requisition 60 days prior to the computed required delivery date and will be processed for material delivery to the requisitioner.

If the demand DELTA value is less than or equal to $2,500 or the demand DELTA quantity is less than or equal to the risk quantity, SPCC will assume the risk, and will load funded PPRs which will in turn generate a procurement.

The IDF candidates which are 9 cog items will be submitted by SPCC to the Defense Logistics Agency unit which handles Special Program Requirement Transactions.

The consensus among the NIF activities is that IDF is an excellent program for solving long term supply problems. However, the program cannot provide quick solutions to the urgently required material needs.

9. Expediting Problems

During the semi-annual ALM Maintenance Workload Conference held in August 1987 a presentation was given on supply support by a representative of NAVAIR-418. During the presentation the problem of how activities should expedite urgently required repair parts was brought up by several representatives in attendance. There was a great deal of confusion over the following issues:

(1) What priority did requisitions have to have assigned before they could be expedited?

(2) What method of expediting would be accepted/desired by SPCC, i.e., Naval message or phone calls to item managers?

(3) When would NAVAIR get involved in the expediting process, i.e., what steps must the requisitioner take before requesting expediting action from NAVAIR?

(4) Who at NAVAIR-418 would take the expediting request for action?

It is clear that an agreement similar to that generated for the IDF program is needed to address a standardized program for delineating methods and responsibilities in expediting of urgently required ALM repair parts. Such an agreement would eliminate the existing confusion and promote greater efficiency among those tasked with expediting duties.

B. NAVY SUPPLY SUPPORT PROVIDED TO CONTRACTOR REPAIR ACTIVITIES

Contractor activities are currently only engaged in providing depot level maintenance for ALM sections and

components. The contract may call for the contractor to provide all repair parts. This is called Contractor Furnished Material (CFM). Another option would be for the government to provide some of the spare parts as Government Furnished Material (GFM), with the remainder provided by the contractor as CFM. An additional option would be for the government to provide all the material as GFM. A derivative of this option is to fund a contractor to purchase the needed repair parts and stock them as GFM. This latter option is currently being used by NAVAIR-418 to support depot maintenance of the Harpoon missile at MDAC.

With the exception of the GFM for the Harpoon missile mentioned above, SPCC (Code 0533) is responsible for providing the GFM repair parts (1H, 7E cog) required by the contractors. Initial stocks of material will be stored at the contractor's plant and will be maintained in bonded storerooms. SPCC is notified of issues made from the bonded storeroom and replenishment requisitions are sent by the contractor to the item managers at SPCC. The current system is labor intensive since the contractors must submit requirements by manual 1348 requisition documents to SPCC.

Contracts usually don't call for GFM unless adequate stocks of material are available to support requirements and a replenishment pipeline is available to replenish stocks. This is because the government would be in a default situation on the contract if it were unable to provide the

GFM, which would in turn create costly delays for the contractor. These costs would ultimately be borne by the government.

SPCC does not develop any allowance lists to support contractor facilities which require GFM. Assets are laid-in to the bonded storerooms based on a fair-share allocation of wholesale system assets and anticipated demand for the assets by the facility.

As discussed earlier the supply support being provided for the depot maintenance of Harpoon missile sections and components is an exception to the norm in GFM support. To support this commercial depot, NAVAIR tasked MDAC to develop and maintain the Harpoon Depot Support Material List (DSML) [Ref. 9:p. 7-7]. The DSML is also referred to as the Harpoon Stock Fund by NAVAIR-418 logistics personnel and Depot Stock Allowance List (DSAL) by MDAC logistics personnel. Stockage of initial bonded storeroom stocks was accomplished by NAVAIR procurement, SPCC procurement and buys of wholesale system stock by NAVAIR. Replenishment of material in the DSML is the responsibility of MDAC and is funded by NAVAIR-418. Replenishment material is provided by MDAC, ordered from subcontractors and also requisitioned from the Navy and DLA supply systems.

Utilizing a model developed by MDAC and NAVAIR-418, repair part quantities required to support the depot maintenance are computed. The model determines new repair

parts requirements in response to changes in the following areas [Ref. 20]:

(1) maintenance philosophy

(2) anticipated return rates of AURs at the NWSs

(3) projected turn-around times for repairs at MDAC

(4) scrap rates

(5) production lead times.

The MDAC system replenishes consumed stock on a quarterly basis and utilizes the minimum-maximum stock level concept. With the exception of specified material such as 4E cognizance group material (high explosives used in the Harpoon warhead) MDAC has the option of obtaining replenishment requirements from the commercial sector if the procurement cost of the item is less than the cost of procuring identical material from a Navy/DLA supply activity. If the Navy/DLA purchase cost is less expensive, MDAC will submit MILSTRIP requisitions for the material.

Currently MDAC is maintaining an inventory of depot stock valued at $53,756,000. This inventory includes 21,700 line items. An additional $19,000,000 worth of assets are now being procured. Discussions with a MDAC logistics engineering executive indicated that ninety-five percent of the material in the inventory was procured from the commercial sector [Ref. 21]. The average administrative lead time for procurement actions by MDAC is approximately 5 months. This is approximately half the administrative lead time reported by SPCC. MDAC is responsible for maintaining

an accountable balance for all assets in the DSML and provides to NAVAIR-418 documented information on consumption and usage.

Probably the best measure of effectiveness (MOE) to use in evaluating the success of the DSML program is System Material Availability (SMA). Table II-3, provided by MDAC, shows a 12 month review of MDAC SMA statistics [Ref. 22:p. 1].

TABLE II-3

MDAC SYSTEM MATERIAL AVAILABILITY (PERCENT) FOR 1986 AND 1987

1986

Jul	Aug	Sep	Oct	Nov	Dec
95	92	90	93	92	91

1987

Jan	Feb	Mar	Apr	May	Jun	Avg
94	95	93	91	86	87	91.6

The MDAC statistics indicate that the DSML has consistently exceeded the SMA goal of eighty-five percent which is specified by SPCC and provided superb supply support to the Harpoon depot maintenance facility.

III. ALTERNATIVES FOR SUPPLY SUPPORT OF THE OMNIBUS CONCEPT

Because the OMNIBUS concept is still in the early developmental phase, no alternatives for the concept have been discarded. Therefore, at this juncture there are numerous alternatives for the type of facility or facilities that may be considered for the Omnibus. Table III-1 depicts some of the decision variables which must be considered.

TABLE III-1

OMNIBUS DECISION VARIABLES

Maintenance Facility Decision Variables

Number of Maintenance Facilities
Location of the Maintenance Facility
Ownership of the Maintenance Facility
Operation of the Maintenance Facility
Ownership of Special Tooling and Test Equipment

Supply Support Facility Decision Variables

Repair Parts Ownership
Provisioning Responsibility
Storage Facility Ownership
Storage Facility Operation
Transportation Ownership/Operation
Location of the Supply Support Facility
Communications and Data Systems for Supply
and Maintenance Support

A. ALTERNATIVES FOR THE DECISION VARIABLES

Each one of the decision variables identified in Table III-1 has alternatives which will be defined in the following sections.

1. Number of Maintenance Facilities

The decision makers' first task will probably be to choose the number of maintenance facilities that will be required for the Omnibus. Theoretically, the alternative selected could be an integer value from one to infinity. Realistically however, the number of maintenance facilities chosen will probably be between 1 and 3. Various measures of effectiveness (MOEs) will be used to evaluate the value selected for this decision variable. For example, maintenance system resistance to hostile attack is an important MOE. The resistance to attack increases with increasing numbers of maintenance facilities. Facility and inventory costs also increase with increasing numbers of maintenance facilities while transportation costs may decrease. Missile readiness is a third MOE which is likely to be affected by the number of maintenance facilities. You might expect missile readiness to increase with increasing numbers of maintenance facilities. However this could depend on choices made with regard to supply support. If spare parts stockage isn't simultaneously increased with increasing numbers of maintenance facilities, ALM readiness

might decrease because of increased mean supply response time for spare parts.

2. Location of the Maintenance Facility

Closely tied to the decision on the number of facilities is the decision variable for location. While theoretically any of the many geographical locations in the United States could be used, realistically only existing government and contractor owned real estate and facilities should be considered as alternatives. Alternatives for either the government or contractors to buy real estate and build facilities are certainly possible but they would result in extensive delays in obtaining an operating Omnibus program.

The measures of effectiveness for evaluating this decision variable will differ depending on the number of maintenance facilities chosen. For example, if only one maintenance site is required, the MOEs to be used in selecting the location may be transportation costs and availability of transportation to move the AUR from the NWSs to the maintenance site. During periods of limited fuel availability and higher demands for transportation resources (which would be experienced during surge and mobilization efforts) the ALM transportation pipeline could be severely constrained. On the other hand, if multiple maintenance facilities are established near the fleet, the impact of higher transportation costs and diminished transportation

resources on the ALM maintenance pipeline would be negligible.

3. <u>Ownership of the Maintenance Facility</u>

The alternatives for this decision variable can either be government owned or contractor owned facilities or both government owned and contractor owned facilities. The decision variable is dependent on the number of facilities selected for the concept. If only one facility is needed, then it will be owned by either the government or a contractor. If more than one facility is required they can all be owned by the government, all owned by a single contractor, some owned by a single contractor and the remainder by the government, and some owned by the government and the remainder owned by multiple contractors. The last category is what currently exists for ALM depot maintenance facilities. An example of an MOE which will be used to evaluate this decision variable will be total cost of the various ownership choices.

4. <u>Operation of the Maintenance Facility</u>

The two choices for this decision variable are either government operation or contractor operation of the facility. An example of an MOE might be the susceptibility of the selected sites to labor problems such as strikes which would impact on the facility's production capabilities.

5. <u>Ownership of Special Tooling and Test Equipment</u>

The decision variable is again limited to two choices of either government ownership or contractor ownership. Contractor ownership of special tooling and test equipment would represent a significant capital investment for the contractor and also increase the contractor's risk. An MOE which might be used would be estimated total life cycle costs for government acquisition of the special tooling and test equipment as compared to total costs of having the items provided by a contractor.

6. <u>Repair Parts Ownership</u>

With the decisions made on what type of maintenance facility will be required for the Omnibus, the decision maker must then choose the alternatives which will form the supply support facility and structure. The two choices for repair parts ownership are called government furnished material (GFM) and contractor furnished material (CFM). Government furnished material is material provided from Navy and DLA supply system assets or from NAVAIR stocked material. Contractor furnished material would be that material which is procured or manufactured by the contractor for Omnibus production use. MOEs which could be used include procurement lead times and acquisition costs for like items.

7. Provisioning Responsibility

The choices for this decision variable are either the Navy Ships Parts Control Center (SPCC) or contractor provisioning. This alternative is closely tied to that of ownership of the repair parts. If the repair parts are CFM, the provisioning effort might best be done by the contractor. If the repair parts are GFM, then the provisioning would probably be the responsibility of SPCC. An exception to this would be the MDAC DSML. In that case the contractor is responsible for the provisioning effort but the repair parts are called GFM.

8. Storage Facility Ownership

The choices for the storage facility for repair parts include government ownership and contractor ownership. The contractor for the storage facility may be different from the contractor owning the maintenance facility. Total cost of the storage might be an MOE that is used.

9. Storage Facility Operation

The choices for the operation of the storage facility are either government or contractor operation. If contractor operated, the contractor may be different from both the owner of the maintenance facility and the supply support facility. An MOE to be used in evaluating this decision variable could be the forecasted inventory accuracy of the storage facility operation under each alternative choice.

10. Transportation Ownership and Operation

The choices for transportation ownership and operation include government and contractor ownership and operation. Government owned transportation could include movement of material on Navy owned trucks and Military Airlift Command aircraft. Contractor owned transportation could include ownership of a transportation system by the same owner or operator of the maintenance or supply support system. Ownership could also be by an unrelated contractor. An MOE which could be used in evaluating this decision variable would be comparison of the life cycle costs of government ownership and operation of transportation equipment versus costs of purchasing transportation services.

11. Location of the Supply Support Facility

Location of the supply support facility will be highly dependent on the selection of the location(s) for the maintenance facility or facilities, the number of facilities chosen, and repair parts ownership. These decision variables must be identified prior to making a decision on the location of the supply support facility. An MOE to be used in the decision variable evaluation might be the mean supply response time (MSRT) that the supply support facility is capable of providing. This MOE will be further discussed in Chapter IV.

12. Communication and Data Systems for Supply and Maintenance Support

Some means for transmitting requirements for repair parts to the supply support system will be needed. A means of keeping records of supply and maintenance data is also required. An obvious candidate for performing these tasks is an existing or a new computer system. The system can either be owned by the government or a contractor. MOEs to be used might be the ease in which a user may operate the system and timeliness of data management.

B. EXAMPLES OF MAINTENANCE FACILITIES AND THEIR SUPPLY SUPPORT REQUIREMENTS

At this point it is important to examine some of the possible maintenance facilities and their supporting supply facilities which may be chosen for the Omnibus program. Table III-2 depicts some of the possibilities. It is important to keep in mind that these possible facility configurations are not individual alternatives but a group of alternatives.

1. Government Owned-Government Operated (GOGO) Single Site Facility

Two major assumptions made at this point are: (1) that the site selected will be one of the existing organic ALM maintenance facilities; and (2) the GOGO facility would obtain all of its supply support from the Navy and DLA supply systems.

TABLE III-2

FACILITY OPTIONS FOR THE OMNIBUS

Facility Type	Single Site Facility	Multiple Site Facilities
Government Owned Government Operated (GOGO)	1	2
Government Owned Contractor Operated (GOCO)	3	4
Contractor Owned Contractor Operated (COCO)	5	6
Contractor Owned Government Operated (COGO)	7	8

Currently SPCC stocks wholesale material to support intermediate and depot level maintenance at the following stock points:

(1) Navy Supply Center (NSC) Oakland

(2) Navy Supply Center (NSC) Norfolk

(3) Concord Naval Weapons Station

(4) Seal Beach Naval Weapons Station, Fall Brook Annex

(5) Yorktown Naval Weapons Station.

This material would now require consolidation at the wholesale stock point servicing the site selected.

If, for example, the site selected was NADEP Alameda then the material would have to be forwarded to NSC Oakland. Oakland is an extremely large supply center and would probably be able to accommodate the additional material.

However, issues of material from NSC Oakland to customers at NADEP Alameda take on the average of two to three days. NADEP Alameda maintains no repairables in NIF stores stock in order to keep the NIF material investment as low as possible. Therefore, all repairables on the average would be received in 2-3 days from NSC Oakland. If the requirement were extremely urgent it would have to be met using hand carried requisitions at NSC Oakland. This would require considerable manpower expenditures by NADEP Alameda.

Receipt, stowage and issue functions at NSCs can also be affected by high priority requirements such as short notice resupply of a deploying battlegroup which would require all available resources and adversely affect other customers. The quality of NSC Oakland's computerized inventory management system also affects receipt, stowage and issue supply support functions. Downtime of the computer system would be directly reflected in the ALM maintenance facility's productivity. Manual issues at an NSC during computer outages are usually restricted to high priority requirements.

If the site selected was a Naval Weapons Station such NWS Concord, additional storage facilities and inventory management personnel would be required to handle the additional material. The primary advantage of having the material at an NWS is that issues of material can be made much faster. Most material at an NWS is ordered,

issued, and received by the customer (if available from on-hand stock) within 24 hours. Supply drivers make several deliveries each day to facilitate timely delivery. There would be no interruptions in the receipt, storage and issue functions due to higher priority commitments as experienced at NSCs. The Supply Departments at NWSs are totally dedicated to providing supply support for both surface and air-launched missile maintenance.

Single siting of wholesale repair parts at either an NSC or an NWS would expose them to a much greater risk of loss due to natural disasters such as flooding and fire. Any facility (such as NWS Concord and NSC Oakland) which is located near the San Andreas fault is also susceptible to earthquake damage. The single siting would also make the facility a more inviting wartime target or a target for terrorists.

An advantage that would be realized through single siting would be the reduction in required NIF inventory quantities. When there is more than one facility, more inventory is necessary because the slower moving items (insurance items) will usually be carried at both facilities in the same quantities as would be kept at one facility. This is due to the difficulty in predicting demand for these items [Ref. 23:p. 220]. Single siting would also eliminate transportation costs incurred for transhipment of material

from stockpoints to requisitioner (such as from NWS Concord to NWS Yorktown).

However, single siting would require transportation of AURs from the NWSs to the Omnibus facility. If NADEP Alameda was selected as the Omnibus maintenance facility then the NWSs would have to transport the AURs to and from Alameda. In the case of NWS Yorktown this would represent a round trip coast to coast move. A dedicated transportation system to move these AURs would be extremely costly but essential to maintaining the maintenance pipeline. Currently MDAC is using a dedicated transportation system to ship RFI sections and new production assets of the Harpoon missile to NWS Concord and NWS Yorktown from the MDAC facility in St. Louis, Missouri. On the return backhaul from the NWSs to MDAC are the NON-RFI sections requiring depot rework. This system allowed the depot turnaround time for Harpoon sections from NWS Yorktown to be reduced from an average of 244 days to 166 days [Ref. 3:p. 25]. The cost of the dedicated transportation system is approximately $180,000-$200,000 per year. The contract is awarded on an annual basis by the Military Transportation Management Command (MTMC). The contract calls for the contractor to make one trip a week to both NWS Concord and Yorktown [Ref. 24].

If a GOGO single or multiple site concept is selected for the Omnibus, those ALMs which have not been

provisioned by SPCC (such as the depot level maintenance supply support for the Harpoon missile) must go through the provisioning process. From the time an ALM is provisioned to the time assets start to be received from the SPCC procurement process is approximately three to three and a half years. ALM availability would be severely affected while this procurement process is starting up.

2. Government Owned-Government Operated (GOGO) Multiple Site Facilities

Again, two major assumptions are made at this point: (1) that the sites selected would be from the existing organic ALM facilities; and (2) the GOGO facilities would obtain all supply support from the Navy and DLA supply systems.

If it was decided to have an East and West Coast facility repairing the same missile types there are several choices. The facilities could either be located at the NADEPs, NWSs or a combination of both.

If the facilities were located at NADEP Alameda and NADEP Norfolk the wholesale supply support would have to be located at NSC Oakland and NSC Norfolk respectively. As previously discussed in Chapter III-B.1 there are drawbacks to this support concept due primarily to the length of time it takes an NSC to make an issue and deliver the parts.

Because the facilities would be repairing the same missile types (i.e., both facilities have the same missile repair capabilities) SPCC would be required to divide

wholesale stock between the supporting activities. This would result in higher costs due to increased capital investment and increased holding costs.

If the facilities were located at either Concord NWS or Seal Beach NWS, Fall Brook Annex on the West coast and Yorktown NWS on the East coast SPCC would be required to split the material between the two sites. The same problems of splitting the wholesale material between NSCs would present themselves if the material was to be split between NWSs.

There would be a considerable advantage to having the wholesale stock at the NWSs due to the significantly reduced issue time to customers which can be achieved at the NWSs versus the lengthy issue, shipment, and receipt pipeline that exists between the NSCs and NADEPs.

If the decision was made to have the facilities maintain different repair capabilities (i.e., all Harpoon missiles repaired at NADEP Alameda and all Phoenix missiles repaired at NADEP Norfolk) SPCC could then consolidate the wholesale stock for the particular ALM at the supporting supply activity.

Another possibility which may be selected would be to have two organic facilities on each coast with an NWS facility performing the intermediate maintenance and an NADEP facility performing the depot level maintenance. If the activities were going to repair all of the ALM systems

at their respective level of maintenance, then SPCC would again be faced with the problem of distributing wholesale stock at the supporting stock points. Having the intermediate level facilities remain at the NWSs would save transportation costs for missile components which check out as good assets on the intermediate level test equipment and do not require depot level maintenance.

3. Government Owned-Contractor Operated (GOCO) Single Site Facility

The assumption made at this point is that the government owned site which is selected for the Omnibus facility would be one of the existing ALM maintenance facilities.

A recent example of a GOCO type maintenance facility was the Avionics Repair Facility at Naval Air Station Lemoore, CA. This facility was operated by McDonnell Douglas to repair selected F/A-18 aircraft avionics components at both the intermediate and depot maintenance levels. In addition McDonnell Douglas managed the inventory of wholesale system repairable assets at another facility at Lemoore called the Wholesale Support Site (WSS) [Ref. 25:p. 4]. NAVAIR provided the funding for the repair contract.

The contractor has three choices for obtaining material supply support which include GFM, CFM and a combination of GFM and CFM. If the contract specifies that GFM will be used SPCC would provide wholesale system stock to the contractor's bonded storeroom. Because of the large

volume of transactions that would occur in the bonded storeroom a computerized transaction reporting system would need to be developed to communicate with SPCC. SPCC would be required to provide for replenishment of the assets used by the Omnibus facility. Once the wholesale material was provided to the bonded storeroom an additional option would be for the contractor to assume responsibility for the replenishment process (as is being done with the Harpoon DSML).

If the contract called for full CFM or contractor replenished GFM, SPCC would be relieved of the responsibility to do the provisioning for the intermediate and depot levels of ALM maintenance, with a few exceptions such as the high explosives used in the warhead.

Having SPCC give up its provisioning responsibilities could prove to be disastrous. It is anticipated that the Omnibus would be awarded as a multi-year contract for a duration of three to five years. The incumbent contractor may not win the subsequent Omnibus contract. The new contractor may desire to have the GFM replenished by SPCC. This would require a major effort by SPCC to restart the ICP management functions. Personnel would have to be identified and trained. The learning curve would be lengthy and supply support would be affected during the transitional period. Job security would be threatened by the uncertainty of future awards of the Omnibus which

might again call for the contractor to replenish GFM or use CFM.

An example of the problem can be seen by reviewing the Harpoon depot level supply support. SPCC has not provisioned for the depot level of maintenance support for the Harpoon. MDAC does not provide data to SPCC on design change notices (DCNs) for items repaired only at the depot level. SPCC's computer data base would require considerable updating prior to any attempt to begin provisioning for the depot level of maintenance for the Harpoon.

Deleting SPCC from the ICP role for the ALM's supply support may also affect fleet surge and mobilization capabilities. SPCC may be in a better position to expand its management functions than a private contractor.

The contractor will probably wish to provide his own material support through the use of CFM or use GFM with the option of contractor replenishment of GFM. Either of these options will allow the contractor to have direct control over the material support function instead of having to depend on another activity for support. Because contractors don't have to comply with the stringent procurement regulations that SPCC must abide by, they can realize significantly reduced contract administrative leadtimes. In addition they can easily contract for urgently required, short notice material needs. The drawback to CFM is the

high cost of capital that the contractor would be required to invest in his inventory.

Probably the most advantageous supply support system (from a contractor standpoint) would be to use GFM, which then is replenished either by contractor procurement or by requisitioning the material from defense supply stock if the material is available and less costly. This is the system that MDAC is using with the Harpoon DSML. MDAC assumes no risk because the capital required for investment in materials is provided by NAVAIR.

4. Government Owned-Contractor Operated (GOCO) Multiple Site Facilities

The assumption to be made again is that the sites selected for the Omnibus would be existing ALM maintenance facilities. A further assumption is that more than one contractor may be selected to operate the individual Omnibus sites.

If only one contractor was selected to operate the multiple sites and was receiving material supply support in the form of GFM (with SPCC as the replenishment source) the contractor would be limited in his resources to the existing levels of wholesale system stock. The contractor would be faced with the problem of how to divide the material in an optimal manner between the repair sites.

If there were multiple contractors operating the selected sites with the same repair capabilities and material needs which are required as GFM (with SPCC as the

replenishment source) the problem becomes more complicated. SPCC would have to try to provide wholesale system stock in an equitable manner at the various bonded storerooms. This may be difficult to do because of the limitations of the wholesale provisioning models with respect to insurance type items. The lack of adequate insurance items would require SPCC to have to direct shipments between different bonded storerooms. This could prove to be difficult because of the inter-company transfers of material.

Another major problem that could develop with GOCO multiple-site facilities would be encountered when there are multiple contractors operating the selected sites and each contractor wants to employ a different supply support system. For example, an East and West coast Omnibus facility are required with the same repair capabilities at both sites. The West coast operations contract is awarded to Raytheon Corporation and the East coast contract is awarded to MDAC. MDAC chooses to continue utilizing the supply support system modeled on the DSML concept for the operation of its facility. Raytheon opts to obtain all of its material as GFM with SPCC and DLA activities performing the replenishment functions. This would require SPCC to have to provision all of the ALMs in the Omnibus concept. However, the quantities of ALMs and support equipment being supported by MDAC could not be used in the SPCC provisioning model.

The result of this provisioning effort by SPCC would be that many items which would have met the procurement criteria with the full population of missiles and support equipment, now fail to meet the criteria. Raytheon would be constrained in the number of insurance items it would have available in the bonded storeroom stock. MDAC on the other hand would not be constrained by the wholesale provisioning model. If MDAC felt strongly that they needed certain insurance items and NAVAIR would agree to fund them, then they would be procured by MDAC as GFM.

To have two different supply systems providing for the replenishment of the GFM does not make good economic sense. Consolidation of the function, either by using the defense supply system or a single contractor, is necessary. This would allow for both administrative economies as well as savings generated through use of consolidated buys and use of economic order quantities (EOQ).

5. Other Facility Configurations

The remaining facility possibilities (5-8 in Table III-2) all call for the Omnibus facilities to be contractor owned which is the only difference between the possibilities that have already been evaluated (1-4 in Table III-2). The government is going to have to fund the costs of the needed supply support facilities which will include warehouses, administrative spaces, storage aids, material handling equipment and computer equipment for inventory management.

The costs of maintaining GFM may, in the case of a contractor owned-contractor operated (COCO) facility, be charged to the government as storage costs. For example, MDAC currently has 21,700 items in the DSML which equates to approximately 10,000 square feet of required storage space. The cost for maintaining the DSML storage space is $26.00 per square foot for a total annual cost of $260,000 [Ref. 22:p. 2]. The example clearly shows that the cost of contractor storage facilities can be considerable.

At contractor owned facilities which have a requirement for replenishment support from SPCC, a computer linkage for transmitting requirements is essential. The Aviation Supply Office (ASO) used a dedicated computer system called the Disk Oriented Supply System (DOSS) to support the F/A-18 aircraft Wholesale Support Site (WSS) at Naval Air Station Lemoore, CA [Ref. 25:p. 3]. A system such as DOSS might be the key to establishing a successful real time link between contractor sites and SPCC which will provide for expeditious stock replenishment.

IV. MEASURES OF EFFECTIVENESS FOR EVALUATING MATERIAL SUPPLY SUPPORT ALTERNATIVES IN THE OMNIBUS PROGRAM

In this chapter measures of effectiveness (MOEs) which can be used to evaluate the material supply support alternatives for the Omnibus program will be examined. Coyle and Bardi [Ref. 23:p. 427] indicate that logistic systems (of which supply support is a subset) can be measured in the following ways:

(1) reliability

(2) total cost

(3) organizational harmony

(4) planning effectiveness

(5) productivity

(6) innovation.

The process of choosing the right MOEs to evaluate alternatives should start with an examination of what the organization's goals and objectives are. Certain MOEs will provide a clearer picture of the alternatives being analyzed if they are correctly matched to organizational goals and objectives. There are many difficulties in accomplishing this task as Quade points out:

> When an individual or public body calls on analysis to help make a decision or choose a policy, it is with a purpose in mind, some objective or goal that the decision or policy is supposed to accomplish. Unfortunately such goals or objectives may not be clearly stated or even fully perceived by the decision maker, let alone be unambiguously communicated to the analyst. In addition

> even for the individual decision-maker and certainly for a composite one, the goals are likely to be multiple and often conflicting. [Ref. 26:p. 85]

Therefore it is important to look at what the objectives of NAVAIR-418 are, before a determination can be made as to what MOEs should be used to evaluate the Omnibus material supply support alternatives.

In a recent corporate business plan NAVAIR-418 presented the following objectives [Ref. 6]:

(1) identify and manage logistical resources

(2) influence airborne weapons system design

(3) insure optimal supportability and provide support throughout total life cycles of ALMs

(4) Meet or exceed Chief of Naval Operations (CNO) asset readiness objectives in a cost effective and timely manner.

These objectives, when coupled with the goals of the Omnibus program highlight the problem of trying to make decisions when you have multiple goals and objectives which are of a conflicting nature. The Omnibus goals which further complicate the analysis and decision making process include [Ref. 6]:

(1) develop a more manageable logistics/maintenance program

(2) create a logistics system which responds to fleet needs

(3) provide improved ALM readiness

(4) provide for effective operation of support facilities

(5) retain surge/mobilization capabilities.

The two predominant concerns raised in both the NAVAIR-418 corporate business plan objectives and the Omnibus program goals are readiness and total cost expectations. The following discussion will examine these very important concerns and their use as MOEs for the Omnibus supply support alternatives.

A. READINESS

At this juncture it is important to note that readiness and availability are synonymous. Readiness goals for ALMs are defined by the CNO and are called asset readiness objectives (AROs). Taylor and Bednash provide an excellent definition for ARO and how ARO is determined:

> ARO is defined as the percentage of missiles in the inventory that are classified as Ready-for-Issue (RFI). These AROs are set by the CNO for the fiscal year with regard to projected fleet requirements for each of the missile systems within the inventory. Calculation of ARO is obtained by dividing the number of projected RFI missiles by the total number of missiles in the inventory. Once the ARO has been set for each missile system by the CNO, NAVAIR-418 must formulate a maintenance plan which meets these objectives. [Ref. 4:p. 14]

The problem with this readiness definition is that it doesn't give any insight into the actual availability, maintainability and reliability of the ALMs.

NAVAIR-418 has recognized the shortcomings of this readiness measure and is in the process of developing a plan for improving the collection, analysis and reporting of reliability, maintainability, availability and quality data [Ref. 27]. The plan is designed to provide NAVAIR with a

single accurate and responsive reliability, maintainability, availability and quality (RMA&Q) assessment capability.[11] The RMA&Q study group's interim report calls for reporting of data in different formats for use by various management levels [Ref. 28]. Of special note is the executive level management report which is to be called the Management Digest Matrix. This report will provide the executive level manager with several factors of interest for reliability, availability and maintainability for each ALM. These factors are described in Appendix B.

From the viewpoint of this thesis the factors which are represented in the Management Digest Matrix which are the most important MOEs are Operational Availability (A_o) and Mean Down Time (MDT). MDT is an MOE which includes both Mean Corrective Maintenance Time (M_{ct}) and Mean Preventative Maintenance Time (M_{pt}) as well as Mean Logistics Delay Time (MLDT) and Mean Administrative Delay Time (MADT). MDT is the elapsed time which is required (when the system is down)

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[11] The following definitions are being used by the NAVAIR Reliability, Maintainability, Availability and Quality (RMA&Q) study group which is responsible for development of the plan:

<u>Reliability</u>: Probability that an item will perform its intended function for a specific time interval under stated conditions.

<u>Maintainability</u>: Measure of the ability of an item to be retained in or restored to an operable condition.

<u>Availability</u>: Measure of the degree a system is in a serviceable condition and committable to the fleet at any random point in time.

to repair and restore a system to its full operational capability or to retain a system in that condition [Ref. 8:p. 44].

Operational Availability (A_o) is defined as the probability that a system or equipment will operate in a satisfactory manner, if used under specified conditions in an <u>actual operational environment</u> [Ref. 8:p. 65]. Operational Availability can be expressed in the following ways:

(1) $$A_o = \frac{MTBM}{MTBM + MDT}$$

(2) $$A_o = \frac{MTBF}{MTBF + MTTR + MLDT + MADT}$$

In the first expression MTBM is the Mean Time Between Maintenance. In the second expression MTBF is the Mean Time Between Failure and MTTR is the Mean Time to Repair which is equivalent to M_{ct}.

Mean Logistics Delay Time (MLDT) comprises one of the biggest elements in MDT. It is made up of maintenance down time which is accumulated while waiting for receipt of spare parts, waiting for transportation, and waiting for availability of required test equipment and facilities [Ref. 8:p. 44]

Although MLDT is a major element of MDT, it has not been broken out as a separate factor for review in the Management

Digest Matrix. This is a major oversight. MLDT is as important or more important than many of the factors proposed for review. Blanchard explains this quite clearly:

> With the advent of new technologies and increasing complexities of systems today, combined with limited resources and reduced budgets, it is essential that all facets of a system be addressed on an integrated basis. If the results are to be effective, logistics must be considered on an integral basis with other elements of the system. [Ref. 8:p. 2]

To manage logistics support it is essential to measure supply and transportation effectiveness together since both affect logistics delay time at a maintenance level. A factor that can be used to evaluate supply and transportation effectiveness is called Mean Supply Response Time (MSRT). MSRT is defined as the average time (in days) required to satisfy customer demands regardless of whether the items required are stocked in the supply system and also regardless of whether the requirements can be filled from stock on hand [Ref. 11:pp. 1-21]. MSRT could be substituted for MLDT in the Operational Availability equation. The reflection of MSRT in the Management Digest Matrix would give the NAVAIR executive level a much clearer understanding of the effects of logistics policies and management upon Operational Availability.

The current MOE used by the Navy wholesale inventory system to evaluate material supply support is System Material Availability (SMA). SMA tries to provide a measurement of the percentage of requisitions which are

filled by the supply system with no delay [Ref. 11:pp. 3-25]. As discussed in Chapter II-A.6 and Chapter II-B both SPCC and MDAC use SMA as an MOE to evaluate supply support. MSRT is a much more useful MOE than SMA because SMA only measures the performance with respect to stockage at a particular level. MSRT, on the other hand, measures everything which SMA measures, plus it measures the very important additional factor of time.

It is recommended that NAVAIR-418 incorporate MSRT as a measure of MLDT into the executive level Management Digest Matrix in order to give managers a complete system view of each ALM. MSRT will highlight both supply and transportation problems which may require executive level attention.

It is also recommended that MSRT be used as an MOE to evaluate the various alternatives for the Omnibus concept. Using available modeling techniques, estimates of MSRT for the alternatives could be obtained to aid the decision maker in making his selection from the alternatives.

B. TOTAL COST

The guidelines for using total costs as an MOE in comparing the alternatives for the Omnibus program are provided in the Department of Defense In-House versus Contract Commercial and Industrial Activities Cost Comparison Handbook [Ref. 29]. The key to having an effective comparison is the adherence to several ground

rules which are outlined in the revised OMB Circular A-76. Two of the most important ground rules are described as follows [Ref. 5]:

(1) Both government and commercial cost figures must be based on the same scope of work and the same level of performance. This requires the preparation of a sufficiently precise work statement with performance standards that can be monitored for either mode of performance.

(2) Cost comparisons are to be aimed at full cost, to the maximum extent practical in all cases. All significant government costs (including allocation of overhead and indirect costs) must be considered, both for direct government performance and for administration of a contract.

The statement of work will require an extensive amount of effort to ensure that the performance by either an in-house government activity or by a contractor will satisfy the government's needs. The statement of work will need to specify standards of performance from which to base an evaluation of the alternatives. Such criteria would include minimum standards to be achieved for some or all of the factors cited in the NAVAIR-418 executive level Management Digest Matrix as well as MSRT. It is important to note that the statement of work should clearly describe <u>what needs to be done</u> but <u>does not prescribe how it should be done</u> [Ref. 29:p. 6].

In order to make fair cost comparisons, all significant government costs must be taken into account. As an example in the area of repair parts, all indirect costs associated with repair parts obtained from other agencies (such as DLA)

will be added to the cost of the repair parts. These indirect costs account for the costs of the acquisition and storage of the material by the agency. In order to reflect full cost, the indirect cost markup to be added to an item which is stocked by a DLA activity is currently 24.5 percent. The markup for an item which is procured by DLA for direct delivery to an activity is 13.4 percent [Ref. 29:p. 15].

An area which cannot be overlooked in making a cost comparison involves the transportation costs which might be incurred by the government if a contractor is chosen to operate the Omnibus facility. Transportation costs could include: transporting government furnished equipment, supplies and material. These costs need to be added to the contractors proposal in order to make an equitable comparison of the costs.

Another tool for evaluating costs of supply support is available in the form of a model called the Availability Centered Inventory Model (ACIM). The model provides a realistic estimate of total inventory requirements at the least total cost to support a specified readiness level assuming that MTBF, M_{ct}, and M_{pt} are fixed by the missile design and won't change in the near term. The model allows the Navy a way to deviate from the standard wholesale models in order to obtain enhanced levels of supply support required to attain the CNO's readiness objectives [Ref.

30:p. 1]. The output from this model would give the decision maker an excellent "should cost" estimate to be used in cost comparisons of supply support alternatives.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

Air-launched missiles have evolved into highly complex and costly weapons systems. The cost of maintaining these ALMs in a RFI state has also grown, along with the missile acquisition cost. These rising maintenance costs can be attributed to the requirement for more complex test equipment, maintenance personnel with increased skill levels, and increasingly expensive repair parts.

The cost of maintaining the missiles is directly proportional to the size of the missile inventory. The ALM missile inventories will swell significantly, tripling in size from 1987 through the year 2000. In an effort to maximize the effectiveness of available maintenance dollars NAVAIR-418 is exploring a new maintenance concept which will combine the intermediate and depot level ALM maintenance functions into one. This new maintenance concept is called the Omnibus and will be a contracted function. This function will be open for bids from both Navy and commercial activities.

As discussed in Chapter III the decision maker has a multitude of alternatives to choose from in selecting the Omnibus structure. The aggregate of the selected alternatives will define a unique supply support structure.

Mean Supply Response Time (MSRT), as a proxy for Mean Logistics Delay Time (MLDT), and total cost comparisons are two MOEs which will be essential to effective evaluation of the various Omnibus alternatives.

Because the Omnibus program is still very much in the developmental stage, it is essential that the health of the existing material supply support system be evaluated and improvements made.

B. CONCLUSIONS

The same level of effort which is being expended to acquire ALMs does not appear to extend to ensuring that sufficient material supply support will be obtained. Vital PSD inputs are not being provided by NAVAIR to SPCC in a timely manner. This lack of PSD inputs has a retarding affect on the whole repair parts provisioning and budgeting process.

The lack of COSBAL support (especially for major support equipment) at both the intermediate and depot level ALM maintenance sites is also of great concern. The current models being used by the Navy Supply System are not adequate to provide the ALM maintenance community with its repair parts needs. The material supply support being provided by commercial activities (such as MDAC's depot level support program) is far superior as evidenced by the SMAs cited in Chapter II-B. This is because the commercial sector is not constrained by restrictive provisioning models, restrictive

procurement regulations and conflicts in funding of stores accounts. It is very difficult to compare Navy and commercial material supply support precisely because the rules by which each organization must abide are so glaringly different. Contractor material supply support appears to be very attractive because of its reduced procurement times, the ability to respond to short notice material requirements and overall flexibility. The question that arises is whether, during periods of austere funding, NAVAIR-418 would be able to provide the funding necessary to procure commercial material supply support on the scale necessary to support the Omnibus concept. Even during periods of austere funding the Navy Stock Fund (NSF) would be able to fill its material supply support role.

C. RECOMMENDATIONS

The following recommendations are made based on the conclusions cited above:

1. NAVAIR-418 and SPCC (Code 0533) convene a meeting to determine the causes of the problems which are making it difficult to transfer PSD inputs from NAVAIR to SPCC for ALMs. Once the problems are resolved it is imperative that future submissions be made in a timely manner.

2. Re-evaluate the policy of not providing COSBAL support to intermediate and depot level ALM facilities because they are NIF funded. At a minimum, informational COSBALs should be prepared by SPCC for all major support equipment used at the two levels of maintenance. NAVAIR should then fund the NIF activities performing ALM maintenance for the purchase of the material identified in the informational allowance list.

3. SPCC needs to explore possibilities for improving procurement administrative leadtimes. The current administrative leadtime average of 10 months is excessive.

4. SPCC and NAVAIR should establish a program to improve the level of communication between ALM logistics managers at NAVAIR and item managers at SPCC. Cooperation between the two groups is essential to improving the quality of the existing material supply support system.

5. SPCC and NAVAIR jointly promulgate procedures to be followed by requisitioners when expediting urgently required material.

6. NAVAIR-418 use Mean Supply Response Time (MSRT) as a proxy for Mean Logistics Delay Time and reflect MSRT data on the executive level Management Digest Matrix report. This will enable NAVAIR executive level managers to identify both supply and transportation problems being encountered by specific missile systems.

7. NAVAIR-418 use operational availability (readiness) and total cost as MOEs in evaluating the Omnibus alternatives.

APPENDIX A

OMNIBUS MAINTENANCE CANDIDATES

1. Harpoon
2. Phoenix
3. Sparrow
4. Sidewinder
5. Harm
6. Sidearm
7. Shrike
8. Walleye
9. AAAM
10. Skipper/LGB
11. SLAM
12. AIWS
13. Containers for the ALMs cited above.

APPENDIX B

RELIABILITY, MAINTAINABILITY AND AVAILABILITY FACTORS

A. Reliability Factors

1. Operational Reliability (R_o), the probability that a system will perform its intended function in the operational environment, as measured at the IMA when returned for SIST/MDD. This method provides an indication of Operational Reliability at the end of the worst case analysis of Operational Reliability. It was selected to present to the NAVAIR executive that "the system is no worse than R_o." Operational Reliabilities for any given period of time or the average Operational Reliability in the fleet will be evaluated using probabilistic models and available data.

2. Test and Evaluation Master Plan (TEMP) Reliability Requirements (R_t), the stated reliability requirement per the system TEMP.

3. Achieved Production Reliability (R_a), the reliability demonstrated by Production Reliability Test.

4. Specified Reliability (R_s), the probability that a system will function for a specified interval under specified conditions. This is also referred to as design reliability.

5. Free Flight Performance Raw (P_r), the flight performance success ratio from planned fleet firings.

6. Free Flight Performance Evaluated (P_e), the flight performance success ratio after analysis of all test and repair factors prior to firing.

B. Maintainability Factors

1. Mean Corrective Maintenance Time (M_{ct}), the average time required to perform corrective maintenance at the Intermediate Maintenance Activity (IMA) and depot (DOP) levels.

2. Mean Preventive Maintenance Time (M_{pt}), the average time to perform scheduled preventive maintenance.

3. Mean Down Time (MDT), this factor includes M_{ct} + M_{pt} + logistic and administrative down time.

4. Turn Around Time (TAT), the total time from system downing to reissue and installation. This is the total time a system is not in the fleet; and includes MDT plus other factors and time periods prior to issue/installation to the fleet.

C. Availability Factors

1. Operational Availability (A_o), the probability that a system is available in the operational environment.

2. TEMP Availability Requirement (A_t), the availability requirement as stated in the TEMP.

3. Achieved Availability (A_a), the probability that a system is available excluding logistic and administrative delay times.

4. Specified Availability (A_s), the probability that a system is available under specified conditions in an ideal support environment.

5. Asset Readiness (A_r), the total assets available over the total assets required.

Source: Commander, Naval Air Systems Command (Code-418), Reliability, Maintainability, Availability and Quality (RMA&Q) Study Team Phase One-Executive Reports, 17 September 1987.

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